

Waves

8-6 The student will demonstrate an understanding of the properties and behaviors of waves. (Physical Science)

8-6.4 Summarize the behaviors of waves (including refraction, reflection, transmission, and absorption).

Taxonomy level: 2.4-B Understand Conceptual Knowledge

Previous/Future knowledge: In 4th grade (4-5.3), students summarized how light travels and explained what happens when it strikes an object (including reflection, refraction, and absorption). Students have not been introduced to the concept transmission in previous grade levels. Students will further develop the concept of the behavior of waves in Physical Science (PS-7.6).

It is essential for students to know that waves have the following behaviors:

Refraction

- *Refraction* is the bending of waves caused by a change in their speed as they pass from one medium to another. As waves pass at an angle from one medium to another, they may speed up or slow down. The greater the change in speed of the waves, the more the waves will bend.
- Refraction of light going from air through a *convex lens*, for example, can make images appear larger as the light waves bend.
- *Prisms* or *diffraction gratings* separate white light into its different components or colors by bending the light at different angles depending on the frequencies of the light passing through the prism or diffraction grating. Different colors of light have different frequencies.

Reflection

- *Reflection* is the bouncing back of a wave when it meets a surface or boundary that does not absorb the entire wave's energy. All types of waves can be reflected.
- Reflections of sound waves, for example, are called echoes and help bats and dolphins learn about their environments.
- *Plane mirrors* and other smooth surfaces reflect light to form clear images.

Transmission

- *Transmission* of waves occurs when waves pass through a given point or medium.
- Sound waves are transmitted through solids, liquids, and gases.
- Light waves are transmitted through *transparent* materials (may be clear or colored material such as filters) that allow most of the light that strikes them to pass through them.
- Only a small amount of light is reflected or absorbed.
- *Opaque* materials allow no light waves to be transmitted through them.
- *Translucent* materials transmit some light, but cause it to be scattered so no clear image is seen.

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Absorption

- *Absorption* of certain frequencies of light occurs when the energy is not transferred through, or reflected by, the given medium.
- Objects or substances that *absorb* any wavelength of electromagnetic radiation become warmer and convert the absorbed energy to infrared radiation.

It is not essential for students to know the quantitative relationships in refraction, reflection, absorption, or transmission of waves. Students do not have to know about the behavior of diffraction or about polarization of light. Measuring angles of reflection or refraction is not essential. Behaviors using concave lenses or convex mirrors and concave mirrors are beyond this indicator.

Assessment Guidelines:

The objective of this indicator is to *summarize* the behaviors of waves; therefore, the primary focus of assessment should be to generalize major points about the interactions of waves with various materials based on behaviors (including refraction, reflection, transmission, and absorption). However, appropriate assessments should also require students to *recognize* the behaviors of waves; *exemplify* the behaviors of waves based on descriptions of these behaviors; *interpret* diagrams of wave behaviors; *illustrate* wave properties; or *explain* the major effects of wave behavior.